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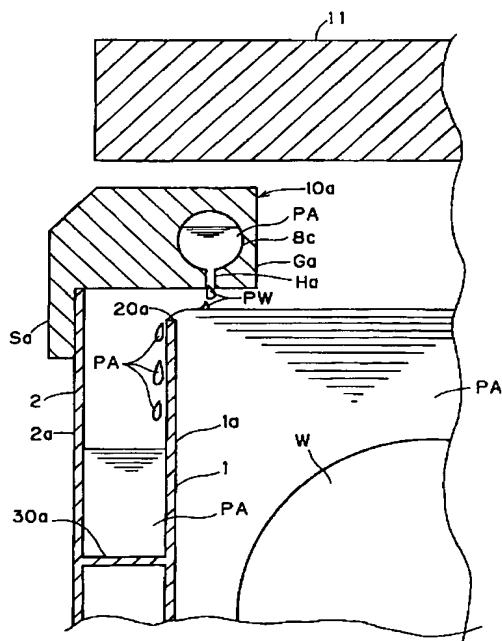
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(54) 【発明の名称】 基板処理装置

(57) 【要約】

【課題】 補充液の突沸が起こらず、なおかつ補充液が処理液中へ十分に拡散するとともに処理液の温度低下が少ない基板処理装置を提供する。

【解決手段】 純水PWは純水注入ノズル10aの複数の純水吹き出し口Haから排出され、その直下の内槽1の内側で内槽1の側面1aの上端である溢流部20a近傍の磷酸溶液PAの表面に至り、磷酸溶液PAと混ざりながら外槽2の樋部30aに至り、外槽2の貯留部30dに流れ込む。したがって、純水PWが内槽1内の磷酸溶液PA内部に至ることがないため純水PWの突沸が起こらず、かつ磷酸溶液PAが内槽1から外槽2に溢流する際に磷酸溶液PAと純水PWが攪拌されるため純水PWが磷酸溶液PA中へ十分に拡散し、さらに磷酸溶液PA表面から直接水分が蒸発することがないので磷酸溶液PAの温度低下が少ない。



## 【特許請求の範囲】

【請求項1】 複数種の液を組み合わせる処理液を処理槽に貯留し、前記処理液の温度を前記複数種の液のうちの少なくとも一種の液の沸点以上に加熱して、前記処理液中に被処理基板を浸漬する基板処理装置において、

前記処理液を貯留し、上端が前記処理液の溢れ出る溢流部とされた内槽と、

前記内槽の前記溢流部から溢れ出た前記処理液を受ける外槽と、

前記外槽で受けた前記処理液を前記内槽に循環させる処理液循環手段と、

前記複数種の液のうち、前記処理液の温度以下の沸点を持つ液を補充液として前記内槽において前記溢流部直上または溢流部近傍に供給する補充液供給手段と、を備えたことを特徴とする基板処理装置。

【請求項2】 請求項1の基板処理装置において、前記複数種の液のうちの前記処理液の温度より高い沸点を持つ液のうちの一種が磷酸であり、前記補充液が純水であることを特徴とする基板処理装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は、半導体基板や液晶ガラス基板等の基板を処理液に浸漬して表面処理を行う装置に関し、特に、複数種の液を組み合わせる処理液を処理槽に貯留し、処理液の温度を処理液を構成する複数種の液の中の少なくとも一種の液の沸点以上に加熱して、処理液中に基板を浸漬する基板処理装置に関する。

## 【0002】

【従来の技術】例えば半導体基板表面のシリコン窒化膜を、高温の磷酸( $H_3PO_4$ )溶液を用いてエッチング処理する際には、磷酸溶液の温度のみならずその濃度が変動すると、エッチング・レートが変化して均一な処理結果が得られない。そのため、磷酸溶液の温度および濃度を許容範囲に維持する必要がある。

【0003】ところが、このようなエッチング処理においては磷酸溶液を $150^{\circ}C \sim 180^{\circ}C$ 程度の高温に保たなければならないため、溶液中の水分が蒸発しやすく、それに伴って磷酸溶液の濃度が上昇してしまい、前述のようなエッチング・レートの変化による処理結果の不均一が生じてしまう。

【0004】そのため、従来は主に以下のような4種類の方法によってエッチング処理の際に純水を磷酸溶液に適宜補充していた。

【0005】1. 実開平2-98631号公報に示されているように、磷酸溶液を収容した処理槽内の下部に、多数の微細な通孔が開けられた壁体を有するノズルを配し、該ノズルを通じて磷酸溶液中に純水を補充する方法。

【0006】2. 特公平3-20895号公報に示され

ているように、処理槽内の磷酸溶液を処理槽外に導き出して温調、フィルタリングし、再び該磷酸溶液を処理槽内に戻すことで磷酸溶液を循環させる循環ライン中に純水を補充する方法。

【0007】3. 実開昭59-84839号公報に示されているように、処理槽の底部の穴から純水を補充する方法。

【0008】4. 特開平6-69179号公報に示されているように、エッチング処理を行う内槽の外側に外槽を設けた二重槽として、内槽から外槽に常時磷酸溶液を溢れさせて、その磷酸溶液が貯留する外槽に上方から純水を注入し、その純水を含んだ磷酸溶液を内槽に循環させる方法。

## 【0009】

【発明が解決しようとする課題】ところで、上記のような純水の補充方法において、1、2および3の方法では純水を磷酸溶液中に注入する構成としているため、磷酸溶液に注入された純水が注入直後に磷酸溶液中において急激に沸騰するといった突沸を起こすことがあった。

【0010】また、4の方法では純水を外槽に貯留した磷酸溶液の表面に注入する構成としているため磷酸溶液の表面で純水が留まってしまい、磷酸溶液中への拡散が起こりにくいととも、磷酸溶液表面から純水が蒸発するために気化熱による磷酸溶液の温度低下が著しかった。

【0011】この発明は、従来技術における上述の問題の克服を意図しており、補充液の突沸が起こらず、なおかつ補充液が処理液中へ十分に拡散するとともに処理液の温度低下が少ない基板処理装置を提供することを目的とする。

## 【0012】

【課題を解決するための手段】上記の目的を達成するため、この発明の請求項1の装置は、複数種の液を組み合わせる処理液を処理槽に貯留し、前記処理液の温度を前記複数種の液のうちの少なくとも一種の液の沸点以上に加熱して、前記処理液中に被処理基板を浸漬する基板処理装置であって、前記処理液を貯留し、上端が前記処理液の溢れ出る溢流部とされた内槽と、前記内槽の前記溢流部から溢れ出た前記処理液を受ける外槽と、前記外槽で受けた前記処理液を前記内槽に循環させる処理液循環手段と、前記複数種の液のうち、前記処理液の温度以下の沸点を持つ液を補充液として前記内槽において前記溢流部直上または溢流部近傍に供給する補充液供給手段と、を備える。

【0013】また、この発明の請求項2の装置は、請求項1の基板処理装置において、前記複数種の液のうちの前記処理液の温度より高い沸点を持つ液のうちの一種が磷酸であり、前記補充液が純水であることを特徴とする。

## 【0014】

## 【発明の実施の形態】

【0015】

【1. 実施の形態における機構的構成と装置配列】図1はこの実施の形態の基板処理装置の外観の斜視図である。また、図2は実施の形態の基板処理装置の概略説明図である。図1では床面に平行な水平面をX-Y面とし、鉛直方向をZ方向とする3次元座標系X-Y-Zが定義されている。

【0016】以下、これらの図を用いてこの実施の形態の基板処理装置の機構的構成を説明していく。

【0017】この基板処理装置は半導体基板上のシリコン窒化膜を、高温度の磷酸溶液を用いてエッチング処理する装置である。この装置は内槽1および外槽2からなる処理槽30を備えており、内槽1は上方が解放された筐体からなっており、内部に150℃～180℃の磷酸溶液PAを貯留し、基板Wが他の処理部から搬送された後にこの内槽1内の磷酸溶液PAに浸漬され、エッチング処理が施される。

【0018】この内槽1の外側には内槽1を内包するように、上方が解放された筐体状の外槽2が固設されており、内槽1の側面上部から外槽2に溢流する磷酸溶液PAを受ける。

【0019】また外槽2の内側には配管3aが外槽2のX方向の正側の側面2dを貫通するように固設され、さらに外槽2内部において配管3aの一端は外槽2の底部近傍に位置している。そして、図1には示されていないが図2に示すように配管3aの他端は外槽2の外部において循環ポンプ4に接続され、また、循環ポンプ4は配管3bを介してヒータ5に接続され、そして、ヒータ5は配管3cを介してフィルタ6に接続されている。さらに、フィルタ6に接続された配管3dは外槽2の側面2dを配管3aより上方において貫通し、外槽2内において内槽1のXの正側の側面を貫通するように固設され内槽1内部において図2に示す磷酸溶液吹出し管12に接続されている。

【0020】一方、図2に示す純水槽7には配管8aの一端が接続され、配管8aの他端には純水PWを予め設定された流量で圧送する定量ポンプ9が接続されている。さらに定量ポンプ9には配管8bの一端が接続されており、配管8bの他端は二又に分かれて配管8cおよび8dに接続され、一方の配管8cは純水注入ノズル10aに接続され、他方の配管8dは純水注入ノズル10bに接続されている。

【0021】また、純水注入ノズル10aは内槽1のY方向の正側の側面1aの上端である溢流部20aの上方近傍に、純水注入ノズル10bは内槽1のY方向の負側の側面1cの上端である溢流部20bの上方近傍に設けられている。

【0022】さらに、純水注入ノズル10a、10bの上方にはエッチング処理時の磷酸溶液PAの飛沫が周囲

に至らないように、図示しないフレームに係止され、基板Wの搬入および搬出時のみ開くとともに、それ以外は閉じられるオートカバー11(11a、11b)が設けられている。

【0023】つぎに、以下において要部の詳細な構成について説明していく。

【0024】図1に示すように、内槽1および外槽2の四方の側面はそれぞれ同一の高さに形成されており、さらに内槽1の高さは外槽2の高さよりわずかに低く形成されている。そして、外槽2と内槽1の間は内槽1の側面1aと外槽2のY方向の正側の側面2aとの間は深さが浅くなった樋部30aが形成されており、同様に、内槽1のX方向の負側の側面1bと外槽2のX方向の負側の側面2bの間に樋部30b、内槽1の側面1cと外槽2のY方向の負側の側面2cとの間に樋部30cが形成されている。さらに、内槽1のX方向の正側の側面1dと外槽2のX方向の正側の側面2dとの間は深くなっており、貯留部30dが形成されている。

【0025】図3はこの実施の形態の基板処理装置の純水注入ノズル10a周辺の部分断面図である。純水注入ノズル10aはその支持部Saが外槽2の側面2aの外側の上部に固設されており、さらに張出し部Gaが内槽1の側面1aの内側まで張り出しており、その張出し部Gaの下面は内槽1の側面1aの上端である溢流部20aの上方近傍に位置している。純水注入ノズル10aの内部には配管8cが挿通されており、図1に示す配管8cの内槽1の上方部分である吹出し位置Uaの下面側には図3に示すように磷酸溶液PAを供給する複数の純水吹出し口Haが図1のX軸方向に等間隔に設けられている。

【0026】なお、純水注入ノズル10bも同様に支持部Sb(図1参照)が外槽2の側面2cの外側上部に固設され、張出し部Gbの下面が内槽1の側面1cの上端である溢流部20bの上方近傍に位置しており、純水注入ノズル10bの内部の配管8dの内槽1の上方部分である吹出し位置Ubの下面側には複数の純水吹出し口HbがX軸の正方向に等間隔に設けられている。

【0027】

【2. 実施の形態における特徴および処理】以下において、この実施の形態の基板処理装置の処理全般および特徴を説明していく。

【0028】基板Wのエッチング処理時、内槽1においてはその四方の側面の上端から磷酸溶液PAをオーバーフローさせている。

【0029】そして、内槽1から外槽2にオーバーフローした磷酸溶液PAは常時配管3aを通じて循環ポンプ4により外槽2から排出され、配管3bを通じてヒータ5に送給され、そこで液温を150～180℃に維持するように加熱される。さらにヒータ5を通った磷酸溶液PAは配管3cを経てフィルタ6に送給され、そこで不

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純物等を除去された後、配管3dを経て内槽1に戻され、ふたたび基板Wのエッチング処理に使用される。このようにこの実施の形態の基板処理装置では磷酸溶液PAを循環させて使用している。

【0030】また、上記のように磷酸溶液PAは液温が150～180℃に維持されていることにより、その内部に含まれる水分は蒸発しやすく、それにより磷酸溶液PAの濃度に変化しやすい。そこで、この装置では純水PWの蒸発にともなう磷酸溶液PAの濃度の変化をオペレータが計測器等により測定し、その測定値から純水PWの単位時間当たりの蒸発量を求め、それに基づいて定量ポンプ9の流量を設定することにより、純水槽7から適当な量の純水PWを純水注入ノズル10a、10bに送給する。

【0031】そして、図3に示すように、純水注入ノズル10a、10bに供給された純水PWは純水注入ノズル10a、10bのそれぞれの複数の純水吹出し口Ha、Hbから排出され、その直下の内槽1の内側で内槽1の側面1aおよび1cのそれぞれの上端である溢流部20aおよび20b近傍の磷酸溶液PAの表面に至り、磷酸溶液PAに混ざり合いながら外槽2の樋部30aおよび30cに至り、外槽2の貯留部30dに流れ込む。

【0032】そして、外槽2の貯留部30dに貯留された磷酸溶液PAは、上記のように配管3a～3d、循環ポンプ4、ヒータ5、フィルタ6を経由して内槽1に戻され、ふたたび基板Wのエッチング処理に使用される。

【0033】このように、この実施の形態の基板処理装置では磷酸溶液PAの溢流部である内槽1の側面1aおよび1cのそれぞれの上端である溢流部20aおよび20bの近傍に純水PWを供給する構成としたため、純水PWが内槽1内の磷酸溶液PA内部に至ることがない。そのため純水PWの突沸が起こらず、なおかつ磷酸溶液PAが内槽1から外槽2に溢流する際に磷酸溶液PAと純水PWが攪拌されるため純水PWが処理液中へ十分に拡散し、それにより純水PWが磷酸溶液PA表面に留まって磷酸溶液PA表面から直接空气中に蒸発することがないので磷酸溶液PAの温度低下が少ない。

【0034】

【3. 変形例】本発明の実施の形態の基板処理装置では、処理液を構成する複数種の液のうちの処理液の温度より高い沸点を持つ液を磷酸液、補充液を純水とする構成としたが、処理液を構成する複数種の液はこれらに限定されるものではなく、たとえば、硫酸液と過酸化水素水を組み合わせて処理液を構成してもよく、この場合には処理液の温度を過酸化水素水の沸点より高温の130℃程度に加熱するため、処理液の温度より高い沸点を持つ液を硫酸液、補充液を純水とする構成である。

【0035】また、この実施の形態の基板処理装置では補充液を純水一種のみとしたが、処理液の温度以下の沸点を持つ複数種の液を補充液とすることも可能である。

【0036】また、この実施の形態の基板処理装置では純水注入ノズル内の配管に複数の純水吹出し口を等間隔に設ける構成としたが、必ずしも等間隔でなくてもよく、純水吹出し口を単数とすることもできる。さらに、純水を供給する手段はこれに限定されるものではなく、たとえば、スリット状の開孔を設ける等の構成としてもよい。

【0037】また、この実施の形態の基板処理装置では磷酸溶液の濃度の変化をオペレータが計測器等により測定し、その測定値から純水の単位時間当たりの蒸発量を求め、それに基づいて定量ポンプによる純水の補充量を設定する構成としたが、磷酸溶液の濃度をセンサ等で時系列的に捉え、そのデータを基に流量制御型のポンプを制御装置で制御することにより純水の補充量を調節する構成としてもよい。

【0038】また、この実施の形態の基板処理装置では、内槽1はその四方の側面の上端の高さを同じにして磷酸溶液が四方から外槽に溢れる構成としたが、本発明は必ずしも四方の側面のすべてから溢れる構成に限られるものではなく、たとえば、内槽1の側面1aおよび1cのそれぞれの上端である溢流部20aおよび20bをX方向の2つの側面より低くして側面1a、1cからのみ溢れる等の構成としてもよい。

【0039】さらに、この実施の形態の基板処理装置では純水注入ノズルを2つ設ける構成としたが、内槽の一侧面に対してのみ純水注入ノズルを1つ設ける構成や、内槽の四方の側面のそれぞれに対して設ける構成としてもよい。

【0040】また本発明の実施の形態の基板処理装置では純水注入ノズル10a、10bの純水吹出し口Ha、Hbを溢流部20a、20bの上方近傍に配しているが、前記純水吹出し口Ha、Hbを溢流部20a、20bの直上に配してもよい。

【0041】

【実施例】なお、この基板処理装置の実施例では純水注入ノズル10はテフロン（デュポン社の4フッ化エチレン重合体の商標名）製であり、内槽1および外槽2は石英製であり、その他の部材も上記のテフロンやPTPF（ポリテトラフルオロエチレン）等の耐熱性、耐食性を備える材料を用いて磷酸溶液による熱や、腐蝕に耐えられるように構成されている。

【0042】さらに、この基板処理装置の実施例では内槽および外槽を併せた処理槽全体の容量を30～40リットルとしており、これに対して定量ポンプの流量の設定値を0～200cc/minの間で調節可能に構成している。このように、この実施例では磷酸溶液の量に対する水分の蒸発量に応じた純水供給量の調節ができる。

【0043】

【発明の効果】以上説明したように、請求項1および請求項2の発明では処理液を構成する複数種の液のうち、

処理液の温度以下の沸点を持つ液を補充液として内槽の処理液が溢れ出る溢流部直上または溢流部近傍に供給する構成としたため、補充液が内槽内の処理液の内部に至ることがないため補充液の突沸が起こらず、なおかつ処理液が内槽から外槽に溢流する際に処理液と補充液が攪拌されるため補充液が処理液中へ十分に拡散し、それにより補充液が処理液表面に留まって処理液表面から直接空气中に蒸発することがないので処理液の温度低下が少ない。

【図面の簡単な説明】

【図1】実施の形態の基板処理装置の外観の斜視図である。

【図2】実施の形態の基板処理装置の概略説明図である。

【図3】実施の形態の基板処理装置の部分断面図である。

【符号の説明】

1 内槽

\*

\* 2 外槽

3 a～3 d 配管

4 循環ポンプ

5 ヒータ

7 純水槽

8 a～8 d 配管

9 定量ポンプ

10 a, 10 b 純水注入ノズル

30 処理槽

10 30 a, 30 b, 30 c 樋部

H a, H b 純水吹出し口

20 a, 20 b 溢流部

1 a, 1 c 内槽の側面

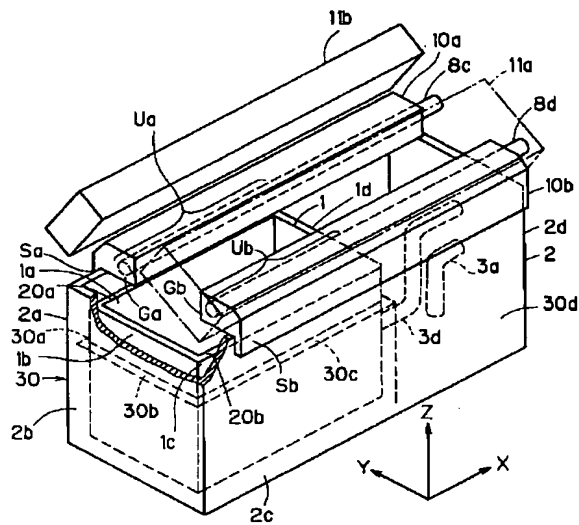
PA 磷酸溶液

PW 純水

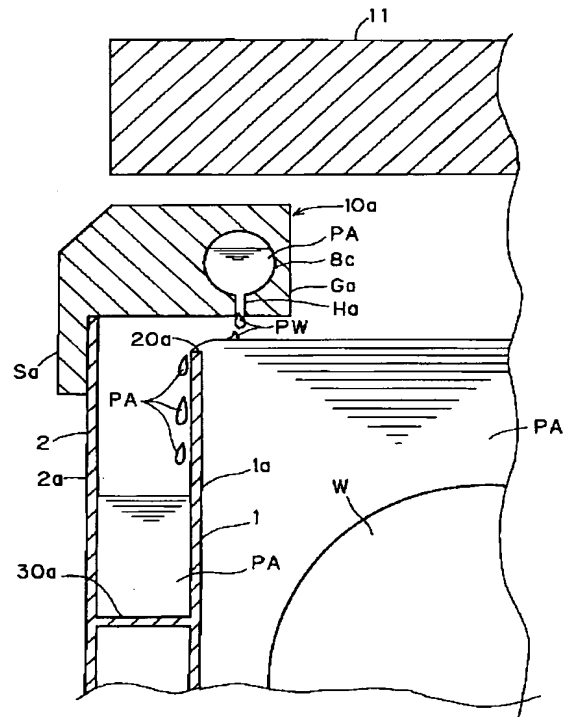
U a, U b 吹出し位置

W 基板

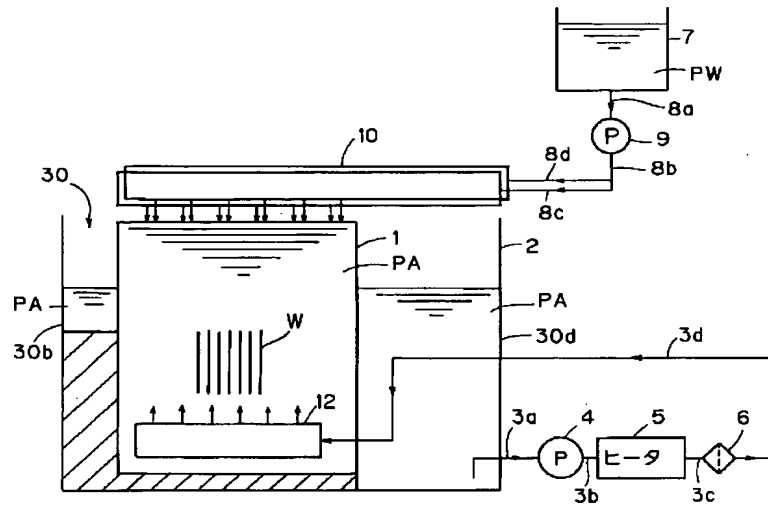
【図1】



【図3】



【図2】



# PATENT ABSTRACTS OF JAPAN

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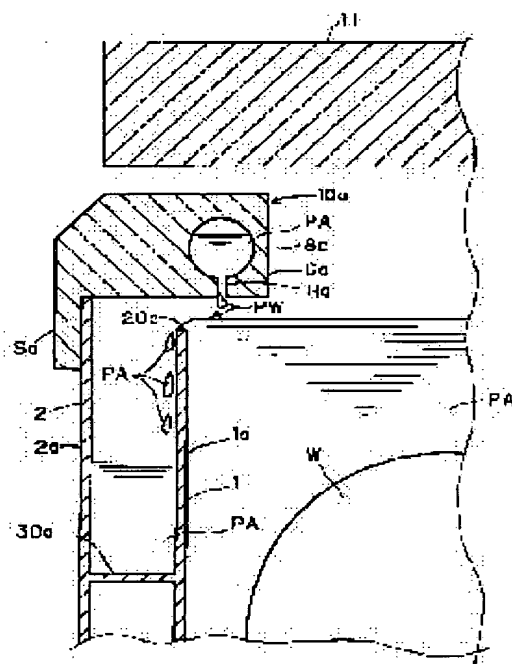
(72)Inventor : OGAMI NOBUTOSHI  
NISHIZAWA HISAO

## (54) SUBSTRATE TREATING APPARATUS

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a substrate treating apparatus whereby a replenished liquid is diffused enough into a treating liq. with a little liq.'s temp drop, without boiling of the replenished liquid.

**SOLUTION:** Pure water PW is drainwater from pure water jet holes Ha of a pure water injection nozzle 10a to the surface of a phosphate soln. PA near an overflowing part 20a at the top end of the inner side face 1a of an inner tank 1 disposed beneath the holes Ha, arrives at a gutter of an outer tank 2 during mixing with the soln. PA and flows into a reservoir 30d of the tank 2. Since the water PW never arrives at the interior of the soln. PA in the tank 1, no boiling of the water occurs and when the soln. PA overflows from the tank 1 to the tank 2, both the liq. PA and water PW are stirred to diffuse the water enough in the soln. PA. Since no water evaporates directly from the surface of the soln. PA, its temp. drop is little.



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**CLAIMS**

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[Claim(s)]

[Claim 1] Processing liquid which comes to combine two or more sorts of liquid characterized by providing the following is stored in a processing tub, and it is said substrate processor which heats more than the boiling point of at least a kind of liquid of the liquid of a seed, and is immersed in a processed substrate into said processing liquid two or more about temperature of said processing liquid. An inner lift which stores said processing liquid and by which an upper bed was made the overflow section in which said processing liquid overflows An outside tub which receives said processing liquid which overflowed from said overflow section of said inner lift A processing liquid circulation means to make said inner lift circulate through the carrier beam aforementioned processing liquid by said outside tub A replenisher supply means to supply right above [ said / overflow section ] or near the overflow section in said inner lift by making into a replenisher said liquid which has two or more boiling points below temperature of said processing liquid among liquid of a seed

[Claim 2] A substrate processor characterized by for a kind of said liquid with two or more boiling points higher than temperature of said processing liquid of the liquid of a seed being phosphoric acid, and said replenisher being pure water in a substrate processor of claim 1.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention stores in a processing tub the processing liquid which combined two or more sorts of liquid especially about the equipment which is immersed in processing liquid in substrates, such as a semiconductor substrate and a liquid-crystal glass substrate, and performs surface treatment, heats the temperature of processing liquid more than the boiling point of at least a kind of liquid in two or more sorts of liquid which constitutes processing liquid, and relates to the substrate processor immersed in a substrate into processing liquid.

[0002]

[Description of the Prior Art] For example, if not only the temperature of a phosphoric acid solution but its concentration is changed in case etching processing of the silicon nitride of a semiconductor substrate front face is carried out using the phosphoric acid ( $H_3PO_4$ ) solution of high temperature, an etching rate will change and a uniform processing result will not be obtained. Therefore, it is necessary to maintain the temperature and concentration of a phosphoric acid solution to tolerance.

[0003] However, in order to have to maintain a phosphoric acid solution at a 150 degrees C – about 180 degrees C elevated temperature in such etching processing, the moisture in a solution will tend to evaporate, the concentration of a phosphoric acid solution will rise in connection with it, and the ununiformity of the processing result by change of the above etching rates will arise.

[0004] Therefore, the phosphoric acid solution was conventionally supplemented with pure water suitably by four kinds of mainly following methods on the occasion of etching processing.

[0005] 1. How to allot nozzle which has wall which many detailed through-holes were able to open to the lower part in processing tub which held phosphoric acid solution, and to supplement it with pure water into phosphoric acid solution through this nozzle as shown in JP,2-98631,U.

[0006] 2. How to fill up pure water all over circulation line which phosphoric acid solution in processing tub is drawn [ circulation line ] out of processing tub, and circulates phosphoric acid solution by \*\* tone and filtering and returning this phosphoric acid solution in processing tub again as shown in JP,3-20895,B.

[0007] 3. How to fill up pure water from hole of pars basilaris ossis occipitalis of processing tub as shown in JP,59-84839,U.

[0008] 4. How to make inner lift circulate through phosphoric acid solution which phosphoric acid solution was always flooded to outside tub from inner lift, poured pure water into outside tub which the phosphoric acid solution stores from the upper part as duplex tub which prepared outside tub in outside of inner lift which performs etching processing as shown in JP,6-69179,A, and contained the pure water.

[0009]

[Problem(s) to be Solved by the Invention] By the way, in the supplement method of the above pure water, bumping that the pure water poured into the phosphoric acid solution boiled at the method of 1, 2, and 3 rapidly in a phosphoric acid solution immediately after impregnation since it is considering as the configuration which pours in pure water into a phosphoric acid solution

might be caused.

[0010] Moreover, since it was considering as the configuration which injects pure water into the front face of the phosphoric acid solution stored in the outside tub by the method of 4, while pure water stops at the front face of a phosphoric acid solution and diffusion into a phosphoric acid solution could not take place easily, since pure water evaporated from a phosphoric acid solution front face, temperature lowering of the phosphoric acid solution by heat of vaporization was remarkable.

[0011] conquest of an above-mentioned problem [ in / in this invention / the conventional technology ] -- meaning -- \*\*\*\* -- bumping of a replenisher -- not happening -- in addition -- and while a replenisher fully diffuses into processing liquid, temperature lowering of processing liquid aims at offering few substrate processors.

[0012]

[Means for Solving the Problem] In order to attain the above-mentioned object, equipment of claim 1 of this invention Store in a processing tub processing liquid which comes to combine two or more sorts of liquid, and temperature of said processing liquid is heated more than the boiling point of at least a kind of liquid of said two or more sorts of liquid. An inner lift which is the substrate processor immersed in a processed substrate into said processing liquid, and stores said processing liquid and by which an upper bed was made the overflow section in which said processing liquid overflows, An outside tub which receives said processing liquid which overflowed from said overflow section of said inner lift, and a processing liquid circulation means to make said inner lift circulate through the carrier beam aforementioned processing liquid by said outside tub, It has a replenisher supply means to supply right above [ said / overflow section ] or near the overflow section in said inner lift by making into a replenisher said liquid which has two or more boiling points below temperature of said processing liquid among liquid of a seed.

[0013] Moreover, in a substrate processor of claim 1, a kind of said liquid with two or more boiling points higher than temperature of said processing liquid of the liquid of a seed is phosphoric acid, and equipment of claim 2 of this invention is characterized by said replenisher being pure water.

[0014]

[Embodiment of the Invention]

[0015]

[The structural configuration and equipment array] in a gestalt of 1. operation Drawing 1 is the perspective diagram of the appearance of the substrate processor of the gestalt of this operation. Moreover, drawing 2 is approximate account drawing of the substrate processor of the gestalt of operation. Three-dimension system-of-coordinates X-Y-Z which makes the level surface parallel to a floor line a X-Y side, and makes the direction of a vertical a Z direction is defined by drawing 1.

[0016] Hereafter, the structural configuration of the substrate processor of the gestalt of this operation is explained using these drawings.

[0017] This substrate processor is equipment which carries out etching processing of the silicon nitride on a semiconductor substrate using the phosphoric acid solution of high temperature. It consists of a case with which this equipment is equipped with the processing tub 30 which consists of an inner lift 1 and an outside tub 2, and, as for the inner lift 1, the upper part was released, and the 150 degrees C - 180 degrees C phosphoric acid solution PA is stored in the interior, after Substrate W is conveyed from other processing sections, it is immersed in the phosphoric acid solution PA in this inner lift 1, and etching processing is performed.

[0018] The tub 2 is fixed to the outside of this inner lift 1 outside the shape of a case from which the upper part was released so that an inner lift 1 might be connoted, and the phosphoric acid solution PA which carries out overflow to the outside tub 2 is received from the side upper part of an inner lift 1.

[0019] Moreover, inside the outside tub 2, it is fixed so that piping 3a may penetrate 2d of sides by the side of positive [ of the direction of X of the outside tub 2 ], and in the outside tub 2 interior, the end of piping 3a is further located in it near the pars basilaris ossis occipitalis of the

outside tub 2. And although not shown in drawing 1 , as shown in drawing 2 , the other end of piping 3a is connected to a circulating pump 4 in the exterior of the outside tub 2, and a circulating pump 4 is connected to a heater 5 through piping 3b, and the heater 5 is connected to the filter 6 through piping 3c. Furthermore, 3d of piping connected to the filter 6 is connected to the phosphoric acid solution blow-off pipe 12 which is fixed so that 2d of sides of the outside tub 2 may be penetrated in the upper part from piping 3a and the side by the side of positive [ of X of an inner lift 1 ] may be penetrated in the outside tub 2, and is shown in drawing 2 in the inner lift 1 interior.

[0020] On the other hand, the end of piping 8a is connected to the pure water tub 7 shown in drawing 2 , and the metering pump 9 which feeds pure water PW by the flow rate set up beforehand is connected to the other end of piping 8a. Furthermore the end of piping 8b is connected to the metering pump 9, the other end of piping 8b is divided into a branch, and is connected to Piping 8c and 8d, one piping 8c is connected to pure water impregnation nozzle 10a, and 8d of piping of another side is connected to pure water impregnation nozzle 10b.

[0021] Moreover, pure water impregnation nozzle 10b is prepared near the upper part of overflow section 20b which is the upper bed of side 1c of the negative side of the direction of Y of an inner lift 1 near [ whose pure water impregnation nozzle 10a is the upper bed of side 1a by the side of positive / of the direction of Y of an inner lift 1 ] the upper part of overflow section 20a.

[0022] Furthermore, while being stopped by the frame which is not illustrated and opening only at the time of carrying in of Substrate W and taking out so that the droplet of the phosphoric acid solution PA at the time of etching processing may not result above the pure water impregnation nozzles 10a and 10b around, the auto covering 11 (11a, 11b) closed is formed except it.

[0023] The detailed configuration of an important section is explained below.

[0024] As shown in drawing 1 , the side of the four way type of an inner lift 1 and the outside tub 2 is formed in the same height, respectively, and the height of an inner lift 1 is further formed low slightly from the height of the outside tub 2. And gutter 30a to which the depth became shallow between side 1a of an inner lift 1 and side 2a by the side of positive [ of the direction of Y of the outside tub 2 ] is formed between the outside tub 2 and the inner lift 1. Similarly, gutter 30c is formed between gutter 30b, side 1c of an inner lift 1, and side 2c of the negative side of the direction of Y of the outside tub 2 between side 1b of the negative side of the direction of X of an inner lift 1, and side 2b of the negative side of the direction of X of the outside tub 2. Furthermore, it is deep between 1d of sides by the side of positive [ of the direction of X of an inner lift 1 ], and 2d of sides by the side of positive [ of the direction of X of the outside tub 2 ], and 30d of reservoir sections is formed.

[0025] Drawing 3 is the fragmentary sectional view of the pure water impregnation nozzle 10a circumference of the substrate processor of the gestalt of this operation. The supporter Sa is fixed to the upper part of the outside of side 2a of the outside tub 2, the overhang section Ga has jutted out pure water impregnation nozzle 10a to the inside of side 1a of an inner lift 1 further, and the underside of the overhang section Ga is located near the upper part of overflow section 20a which is the upper bed of side 1a of an inner lift 1. Piping 8c is inserted in the interior of pure water impregnation nozzle 10a, and two or more pure water exit cones Ha which supply the phosphoric acid solution PA to the underside side of the blow-off location Ua which is the upper part portion of the inner lift 1 of piping 8c shown in drawing 1 as shown in drawing 3 are formed in X shaft orientations of drawing 1 at equal intervals.

[0026] In addition, Supporter Sb (refer to drawing 1 ) is similarly fixed to the outside upper part of side 2c of the outside tub 2 for pure water impregnation nozzle 10b. It is located near [ whose underside of the overhang section Gb is the upper bed of side 1c of an inner lift 1 ] the upper part of overflow section 20b, and two or more pure water exit-cone Hb is prepared in the positive direction of the X-axis at equal intervals at the underside side of the blow-off location Ub which is the upper part portion of an inner lift 1 of 8d of piping inside pure water impregnation nozzle 10b.

[0027]

[The feature and processing] in the gestalt of 2. operation The processing at large and the feature of a substrate processor of this operation are explained below. [ of a gestalt ]

[0028] The phosphoric acid solution PA is made to overflow from the upper bed of the side of the four way type in an inner lift 1 at the time of etching processing of Substrate W.

[0029] And the phosphoric acid solution PA overflowed from the inner lift 1 to the outside tub 2 is always discharged from the outside tub 2 by the circulating pump 4 through piping 3a, is fed by the heater 5 through piping 3b, and it is heated so that solution temperature may be maintained at 150–180 degrees C there. After the phosphoric acid solution PA which furthermore passed along the heater 5 being fed by the filter 6 through piping 3c and removing an impurity etc. there, it is returned to an inner lift 1 through 3d of piping, and is again used for etching processing of Substrate W. Thus, it is used in the substrate processor of the gestalt of this operation, circulating the phosphoric acid solution PA.

[0030] Moreover, as mentioned above, when solution temperature is maintained by 150–180 degrees C, the moisture contained in the interior tends to evaporate, and, thereby, as for the phosphoric acid solution PA, the concentration of the phosphoric acid solution PA tends to change. So, with this equipment, a suitable quantity of pure water PW is fed into the pure water impregnation nozzles 10a and 10b from the pure water tub 7 by an operator's measuring change of the concentration of the phosphoric acid solution PA accompanying evaporation of pure water PW with a measuring instrument etc., calculating the evaporation per unit time amount of pure water PW from that measured value, and setting up the flow rate of a metering pump 9 based on it.

[0031] And as shown in drawing 3, the pure water PW supplied to the pure water impregnation nozzles 10a and 10b is discharged from each pure water exit cones Ha and Hb of two or more of the pure water impregnation nozzles 10a and 10b. The front face of the phosphoric acid solution PA overflow section 20a which is each upper bed of the sides 1a and 1c of an inner lift 1 by the inside of the inner lift [ directly under ] 1 of it, and near the 20b is reached, and it results in the gutters 30a and 30c of the outside tub 2, being mixed with the phosphoric acid solution PA, and flows into 30d of reservoir sections of the outside tub 2.

[0032] And the phosphoric acid solution PA stored by 30d of reservoir sections of the outside tub 2 is returned to an inner lift 1 as mentioned above via Piping 3a–3d, a circulating pump 4, a heater 5, and a filter 6, and is again used for etching processing of Substrate W.

[0033] Thus, in the substrate processor of the gestalt of this operation, it writes as the configuration which supplies pure water PW near the overflow sections 20a and 20b which are each upper bed of the sides 1a and 1c of the inner lift 1 which is the overflow section of the phosphoric acid solution PA, and pure water PW does not reach the interior of phosphoric acid solution PA in an inner lift 1. therefore, bumping of pure water PW -- not happening -- in addition -- and since the phosphoric acid solution PA and pure water PW are stirred in case the phosphoric acid solution PA carries out overflow to the outside tub 2 from an inner lift 1, and pure water PW is fully spread into processing liquid, pure water PW stops at a phosphoric acid solution PA front face by that cause and it does not evaporate in direct air from a phosphoric acid solution PA front face, there is little temperature lowering of the phosphoric acid solution PA.

[0034]

[3. modification] Although considered as the configuration which uses as phosphoric acid liquid liquid with the boiling point higher than the temperature of the processing liquid of two or more sorts of liquid which constitutes processing liquid, and uses a replenisher as pure water in the substrate processor of the gestalt of operation of this invention Two or more sorts of liquid which constitutes processing liquid is not what is limited to these. For example In order to constitute processing liquid combining sulfuric-acid liquid and hydrogen peroxide solution and to heat the temperature of processing liquid at hot about 130 degrees C from the boiling point of hydrogen peroxide solution in this case, it is the configuration which uses liquid with the boiling point higher than the temperature of processing liquid as sulfuric-acid liquid, and uses a replenisher as pure water.

[0035] Moreover, although the replenisher was made only into a pure water kind in the substrate processor of the gestalt of this operation, it is also possible to make two or more sorts of liquid with the boiling point below the temperature of processing liquid into a replenisher.

[0036] Moreover, although considered as the configuration which prepares two or more pure water exit cones in piping in a pure water impregnation nozzle at equal intervals in the substrate processor of the gestalt of this operation, you may not necessarily be regular intervals and a pure water exit cone can also be made into an unit. Furthermore, a means to supply pure water is good also as a configuration of it not being limited to this and preparing [ for example, ] slit-like puncturing.

[0037] Moreover, although considered as the configuration which an operator measures change of the concentration of a phosphoric acid solution with a measuring instrument etc., calculates the evaporation per unit time amount of pure water from that measured value, and sets up the amount of supplements of the pure water by the metering pump based on it in the substrate processor of the gestalt of this operation It is good also as a configuration which adjusts the amount of supplements of pure water by catching the concentration of a phosphoric acid solution serially by a sensor etc., and controlling the pump of a control-of-flow mold by the control unit based on the data.

[0038] Moreover, although the inner lift 1 made the same the height of the upper bed of the side of that four way type and considered as the configuration in which a phosphoric acid solution is full of an outside tub from a four way type in the substrate processor of the gestalt of this operation This invention is good also as a configuration of it necessarily not being restricted to the configuration which overflows from all the sides on all sides, making lower than two sides of the direction of X the overflow sections 20a and 20b which are each upper bed of the sides 1a and 1c of an inner lift 1, and overflowing only from Sides 1a and 1c.

[0039] furthermore, although considered as the configuration which prepares two pure water impregnation nozzles in the substrate processor of the gestalt of this operation, it is good also as the configuration which prepares one pure water impregnation nozzle only to the 1 side of an inner lift, and a configuration which the side of the four way type of an inner lift boils, respectively, and is received and prepared.

[0040] Moreover, although the pure water exit cones Ha and Hb of the pure water impregnation nozzles 10a and 10b are allotted near the upper part of the overflow sections 20a and 20b in the substrate processor of the gestalt of operation of this invention, said pure water exit cones Ha and Hb may be allotted to right above [ of the overflow sections 20a and 20b ].

[0041]

[Example] In addition, the pure water impregnation nozzle 10 is a product made from Teflon (brand name of the ethylene tetrafluoride polymer of Du Pont), and an inner lift 1 and the outside tub 2 are the products made from a quartz, and they consist of examples of this substrate processor so that the heat by the phosphoric acid solution and corrosion can be borne using the material with which other members are also equipped with thermal resistance, such as the above-mentioned Teflon and PTFE (polytetrafluoroethylene), and corrosion resistance.

[0042] Furthermore, capacity of the whole processing tub which combined the inner lift and the outside tub is made into 30-40l., and the set point of the flow rate of a metering pump consists of examples of this substrate processor possible [ accommodation ] between 0 - 200 cc/min to this. Thus, in this example, accommodation of the pure water amount of supply according to the evaporation of the moisture to the amount of a phosphoric acid solution can be performed.

[0043]

[Effect of the Invention] The inside of two or more sorts of liquid which constitutes processing liquid from invention of claim 1 and claim 2 as explained above, It writes as the configuration supplied [ near / where the processing liquid of an inner lift overflows by making liquid with the boiling point below the temperature of processing liquid into a replenisher / right above / overflow section / or near the overflow section ]. Since a replenisher does not reach the interior of the processing liquid in an inner lift, bumping of a replenisher does not happen. in addition -- and since processing liquid and a replenisher are stirred in case processing liquid carries out overflow to an outside tub from an inner lift, and a replenisher fully diffuses into processing liquid, and a replenisher stops at a processing liquid front face and does not evaporate in direct air from a processing liquid front face by that cause, there is little temperature lowering of processing liquid.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram of the appearance of the substrate processor of the gestalt of operation.

[Drawing 2] It is approximate account drawing of the substrate processor of the gestalt of operation.

[Drawing 3] It is the fragmentary sectional view of the substrate processor of the gestalt of operation.

[Description of Notations]

1 Inner Lift

2 Outside Tub

3a-3d Piping

4 Circulating Pump

5 Heater

7 Pure Water Tub

8a-8d Piping

9 Metering Pump

10a, 10b Pure water impregnation nozzle

30 Processing Tub

30a, 30b, 30c Gutter

Ha, Hb Pure water exit cone

20a, 20b Overflow section

1a, 1c The side of an inner lift

PA Phosphoric acid solution

PW Pure water

Ua, Ub Blow-off location

W Substrate

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[Translation done.]